Figure 4.3
Cost And Returns Of Grape Cultivation (Per Acre)
This chapter is mainly based on primary data collected from the sample respondents cultivating grapes in the selected three blocks, namely Chinnamanur, Uthamapalayam and Cumbum in Theni district. In the analysis of results and discussion, an attempt is made to analyse the resource use efficiency in grape cultivation in the selected blocks of Theni district.

Resources are scarce and have alternative uses as well. The term resource use efficiency in agriculture may be broadly defined to include the concepts of technical efficiency, allocative efficiency and environmental efficiency. An efficient farmer allocates his land, labour, water and other resources in an optimal manner so as to maximise his income at least cost on sustainable basis\textsuperscript{125}. The concept of scarcity of resources is of vital importance in economic theory. As a matter of fact, economics is concerned with overcoming the effects of scarcity by improving the efficiency of scarce resources.\textsuperscript{126} Examination of efficiency, absolute or relative, has always been one of the important goals of production economics\textsuperscript{127}.


The inadequacy of capital and other resource inputs combined with their inefficient use is being commonly reported to be the prime cause of low crop productivity under a given set of ecological, social, managerial, and technological conditions at a particular point of time. The inefficiencies in the use of various resources affect productivities of crops and also their cost and returns structure and producer’s incentives as well\(^\text{128}\).

To get a realistic picture as to how resources are used in the cultivation of crops, particularly in an important commercial crop like grape, an attempt is made to study resource use efficiency. To what extent the available resources are utilized by the small, medium and large farmers in the study area producing grape is also examined.

**Measures of Resource Use Efficiency**

Measuring productivity of resources is a complex issue. Yet, economists and researchers have attempted to study productivity of resources and resource-use efficiency because such measures provide useful insights into the relationship between inputs and output. There are two measures to calculate the productivity of a resource. They are:

1) Conventional measure and

2) Production function approach.

1. Conventional Measures

In conventional measure, the productivity of a resource is calculated in terms of Gross Average Productivity (GAP) and Residual Average Productivity (RAP).

**Gross Average Productivity (GAP)**

Gross Average Productivity is computed in order to find out the productivity of labour, capital and land. Kombairaju has computed gross average productivity to find out the productivity of labour and capital.\(^{129}\) Gross Average productivity is expressed in two forms, they are: (1) Gross Average Physical Productivity (GAPP) and (2) Gross Average Value Productivity (GAVP).

Gross Average Physical Productivity of labour (in quintal per manday) has been calculated by dividing the total output in physical terms (in quintal) by total number of mandays.

\[
\text{Yield (in quintal)} = \frac{\text{GAPP of Labour}}{\text{Total labour units (in mandays)}}
\]

Gross Average Value Productivity of labour (in rupees per manday) is measured by dividing the total value of output in monetary terms (in rupees) by total number of mandays.

\[
\text{GAVP of labour} = \frac{\text{Total value of produce (in `)}}{\text{Total labour units (in mandays)}}
\]

Gross Average Physical Productivity of capital (in quintal per manday) has been calculated by dividing the total output in physical terms (in quintal) by the total value of non-labour services (in rupees).

\[
\text{GAPP of Capital} = \frac{\text{Yield (in quintal)}}{\text{Total value of non labour services (in `)}}
\]

The Gross Average Value Productivity of capital (in rupees per mandays) is measured by dividing the total value of output in monetary terms (in rupees) by the total value of non labour services (in rupees).

\[
\text{GAVP of Capital} = \frac{\text{Total Value of Produce (in `)}}{\text{Total value of non labour services (in `)}}
\]
Residual Average Productivity (RAP)

The residual average productivity is a relatively more accurate measure than the gross average productivity of resources. The residual average productivity is classified into two;

1) Residual Average Labour Productivity (RALP), and

2) Residual Average Capital Productivity (RACP)

The Residual Average Labour Productivity (in rupees per man-day) is computed by deducting the value of non-labour services from the total value of the output, and dividing the net value by the Number of Labour Units (NLU) in

\[ RALP = \frac{(TVO - VNLCS)}{NLU} \]

The value of Residual Average Capital Productivity (in rupees per manday) is calculated by deducting the value of labour units from the total value of output (in rupees) and dividing the balance by the VNLCS.\(^{130}\)

\[ RACP = \frac{(TVO - VLU)}{VNLCS} \]

\(^{130}\) Ibid
Resource use efficiency was calculated using the production function analysis. The specific contribution of the individual resources computed from the production function analysis provided the necessary information for efficient individual resource allocation.

2. Production Function Analysis

In order to study resource use efficiency, that is, how resources are used in grape cultivation, production function analysis was adopted. A production function is a complex analytical tool which describes the maximum output that can be obtained from a given set of inputs in the existing state of technical knowledge.\textsuperscript{131}

By and large, there are five different forms of production function in the existing literature. They are Leontiff type (fixed co-efficient) production function, linear production function, Cobb - Douglas production function, constant elasticity of substitution (CES) production function and variable elasticity of substitution production function. These types production function differ from each other by the numerical value of the elasticity of substitution.

Of the different forms of the production function, Cobb-Douglas production function has been the most popular in empirical research.\textsuperscript{132} This algebraic model provides a compromise between

(a) adequate fit of the data,

(b) computational feasibility, and

(c) sufficient degree of freedom unused to allow for statistical testing.\textsuperscript{133}

As there were differences in grape yield per acre between small, medium and large farmers, separate production function was fitted for small, medium, large and overall farmers.

Cobb-Douglas type of production function was fitted to input-output data to estimate the resource use efficiency. Cobb-Douglas production was preferred for its computational ease. The form of the function used was as follows:

\[ Y = a x_1^{b1} x_2^{b2} x_3^{b3} x_4^{b4} x_5^{b5} x_6^{b6} e^u \]


On the logarithmic scale the function takes a linear form

\[ \log Y = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + U \]  

\[(5.1)\]

Where

\[ Y = \text{Gross return in rupees per acre} \]

\[ X_1 = \text{Human labour in rupees per acre} \]

\[ X_2 = \text{Cost of Fertilizer in rupees per acre} \]

\[ X_3 = \text{Cost of pesticide in rupees per acre} \]

\[ X_4 = \text{Weeding in rupees per acre} \]

\[ X_5 = \text{Manuring in rupees per acre} \]

\[ X_6 = \text{Watch and ward per acre} \]

\[ U = \text{Disturbance term} \]

\( \beta_0, \beta_1, \beta_2, ..., \beta_6 \) are parameters to be estimated.

**Structural Differences in Production Relations**
The structural differences in production relation between Muscat and Thompson Seedless varieties were tested. For this, the above model (5.1) was fitted separately for each variety and for pooled data of two varieties of grapes.

In order to examine the structural difference, between two varieties, Chow’s F-test was carried out.

\[
F = \frac{\left\{ \sum e^2 - (\sum e_1^2 + \sum e_2^2) \right\} / k}{(\sum e_1^2 + \sum e_2^2) / (n_1 + n_2 - 2k)}
\]

where,

- \( \sum e^2 \) = Unexplained or residual sum of squares of the Pooled sample of both Muscat and Thompson Seedless varieties,
- \( \sum e_1^2 \) = Unexplained or residual sum of squares of the sample corresponding to Muscat variety,
- \( \sum e_2^2 \) = Unexplained or residual sum of squares of the sample corresponding to Thompson Seedless variety,
- \( n_1 \) = Number of observations in Muscat variety,
- \( n_2 \) = Number of observations in Thompson Seedless varieties and
- \( k \) = The number of parameters included in the regression model.

If the computed value of \( F^* \) is less than table value of \( F \) at appropriate level of significance for \( (n_1 + n_2 - 2k) \) degrees of freedom, one can accept the hypothesis...
that there is no structural difference in production relation between the two varieties of grapes. In case, the structural differences are found to exist in their production relation between two varieties, dummy variables may be introduced both at the intercept and slope levels to find out whether the structural differences occur at the intercept level or the slope level or both.

The following form of regression model is worked out to study the structural differences in production relation between the two varieties.

$$
\log Y = \alpha_0 + \alpha_1 D + \sum \beta_i \log X_i + D \sum \log X_i + u \quad \text{------- (5.3)}
$$

In equation (5.3) D is the dummy variable representing 0 and 1 for Muscat and Thompson Seedless varieties of grapes respectively.

The regression equation (5.1) and (5.3) are estimated by using the method of least squares.

Efficiency of resource use is taken in its strict theoretical sense that implies equality of marginal value productivity (MVP) to marginal factor cost\(^{18}\). The MVP of a particular resource represents “the expected addition factor to the output caused by an addition of one more unit of that resource while other inputs are held constant\(^{134}\).

With the help of the regression coefficients, the marginal value productivities (MVPs) of resources were worked out. The most reliable and perhaps the most useful estimate of MVP are obtained by taking the resources ($X_1$) as well as output ($Y$) at their geometric means.

The marginal value productivities (MVPs) were calculated at the geometric mean level of the variables by using the following formula:

$$\frac{\text{Geometric mean of } Y}{MVP_{X_i}} = b_i \quad \frac{\text{Geometric mean of } X_i}{\text{Geometric mean of } X_i}$$

Where

$$b_i = \text{Elasticity coefficient of the } i^{th} \text{ variable}$$

$$Y = \text{Yield of grape in } C \text{ for the } i^{th} \text{ variable per acre, and}$$

$$X_i = \text{Geometric mean of } i^{th} \text{ independent variable}$$

After having computed the marginal value productivity of a resource input, the resource use efficiency of farmers as users of resources in grape cultivation was evaluated. In order to evaluate the economic efficiency of resource use by the grape farmers, K.S. Chandrashekar and M.V. Srinivasa Gowda, (1996). “Resource Use Efficiency in Groundnut Production under Rain-fed Condition – A Study in Challakere Taluk of Karnataka”, Agricultural Situation in India, September, p.388.
cultivators, the ratios of marginal value productivities to their factor costs were calculated. A ratio Marginal Value Productivity (MVP)/Marginal Factor Cost (MFC) that is equal to unity indicates the optimum use of that factor. A resource is considered to be used most efficiently if its MVP is just sufficient to offset its cost. A ratio of more than unity indicates that the output can be increased by using that resource and a less than unity ratio indicates the unprofitable level of resource use which should be decreased to minimize the losses.

Determinants of Yield

In order to measure the relative contribution of each factor in combination with other factors which are responsible for the changes in the level of output of grape, a multiple linear regression model of the Cobb-Douglas type was fitted separately for the three categories of farmers under variety-wise cultivation of grapes, namely, Muscat, Thompson and overall farmers. In the following section, the results of the fitted regression models are discussed for the three categories of farmers.

The regression model (5.1) was estimated by the method of least squares for Muscat variety, Thompson Seedless variety of grape and overall data separately. The results are presented in Table 5.1.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter Estimate (Production Elasticities)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Muscat Variety</td>
</tr>
</tbody>
</table>

Table 5.1

ESTIMATED REGRESSION RESULTS OF SELECTED GRAPES CULTIVATION IN THENI DISTRICT

<table>
<thead>
<tr>
<th>Intercept</th>
<th>1.2679</th>
<th>1.6548</th>
<th>0.9738</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log $X_1$</td>
<td>0.3229** (12.81)</td>
<td>0.2129* (2.29)</td>
<td>0.3437** (11.98)</td>
</tr>
<tr>
<td>Log $X_2$</td>
<td>0.1892** (4.38)</td>
<td>0.1136 (1.24)</td>
<td>0.1021** (5.36)</td>
</tr>
<tr>
<td>Log $X_3$</td>
<td>0.1431* (2.09)</td>
<td>0.1351 (1.67)</td>
<td>0.0442* (2.29)</td>
</tr>
<tr>
<td>Log $X_4$</td>
<td>0.0147** (4.78)</td>
<td>0.0758 (0.82)</td>
<td>0.1014** (5.39)</td>
</tr>
<tr>
<td>Log $X_5$</td>
<td>0.2367** (11.19)</td>
<td>0.2478** (4.22)</td>
<td>0.2317** (12.18)</td>
</tr>
<tr>
<td>Log $X_6$</td>
<td>0.1167 (0.59)</td>
<td>0.1669 (1.75)</td>
<td>0.1093 (1.21)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.74</td>
<td>0.69</td>
<td>0.72</td>
</tr>
<tr>
<td>F-value</td>
<td>52.58</td>
<td>34.69</td>
<td>54.18</td>
</tr>
<tr>
<td>No of Observations</td>
<td>182</td>
<td>118</td>
<td>300</td>
</tr>
</tbody>
</table>

Note: Figures in brackets are the t-values

*Indicates that the co-efficients are statistically significant at 5 per cent level.

**Indicates that the co-efficients are statistically significant at 1 per cent level.

From Table 5.1, it is found that five out of six independent variables were found to be positively related to the yield of grapes in respect of Muscat variety. The independent variable watch and ward was found to be negatively related to the yield of grapes for Muscat variety. These six explanatory variables included in the linear regression model explained about 74 per cent of the variations in the per acre yield of grapes for Muscat variety. The explanatory variables, human labour, fertilizer, weeding
and manuring emerged statistically significant at one per cent level. The variable pesticide was found to be statistically significant at five per cent level.

The human labour, fertilizer, weeding and manuring were observed to be the dominant and most influential determinants of yield of grapes for Muscat variety. This implied that yield of grapes could be increased by 0.3229, 0.1892, 0.0147 and 0.2367 per cent each by one per cent increase in each of the three variables respectively. It may also be inferred that the regression model is statistically significant since the F-value emerged statistically significant at one per cent level.

In the case of Thompson varieties about 69 per cent of the variations in the yield of grapes were explained by the six explanatory variables included in the regression model. Except watch and ward, all other explanatory variables were found to have positive impact on yield. Of the six explanatory variables, human labour was found to be statistically significant at 5 per cent level and the variable manure was found to be significant at one per cent level. This implies that an additional percentage increase in each of these variables, human labour and manure is capable of increasing the yield of grapes by 0.2129 and 0.2478 per cent respectively for Thompson variety. Variables fertilizer and pesticides were found to be capable of increasing the yield of grapes of Thompson varieties by 0.1136 and 0.1351 per cent respectively. But these two variables
were not statistically significant. The regression model was found to be statistically significant at five per cent level.

In the case of total vineyard, all the six independent variables included in the model were responsible for about 72 per cent of the variations in the yield of grapes of both Muscat and Thompson varieties. Except watch and ward, all other five independent variables exercised a positive influence on the yield of grapes. The independent variables human labour, fertilizer, weeding and manuring were found to be statistically significant at one per cent level. Pesticide was statistically significant at 5 per cent level. The influence of human labour and manuring was observed to be greater in determination of yield of grapes in respect of total vineyard. It implies that if each of these independent variables is increased by one per cent, yield of grapes would increase by 0.3437 and 0.2317 per cent respectively for the above category of farmers. The model was also found statistically significant at one per cent level.

Thus, in the regression model fitted to identify the determinants of yield of grapes per acre for Muscat and Thompson varieties and total vineyards, six independent variables were considered. For all the three categories of vineyards, two variables human labour and manure were found to have greater impact on yield per acre and also emerged statistically significant. In the case of Muscat and Thompson varieties and total vineyard, five independent variables were statistically significant. The overall regression
model of the three categories of vineyard was also found significant at five per cent level.

**Test for Structural Difference:**

Table 5.12 shows the results of the Chow’s test used to find out whether structural differences existed between Muscat and Thompson varieties of grapes.

\[
F^* = \frac{[\sum e^2 - (\sum e^2_1 + \sum e^2_2)]/k}{(\sum e^2_1 + \sum e^2_2)/(n_1+n_2-2k)}
\]

\[F^* = 33.875. \quad F_{7,286} \text{ at } 1\% \text{ level} = 2.64\]
TABLE 5.2
TEST FOR EQUALITY OF PARAMETERS BETWEEN MUSCAT AND THOMPSON SEEDLESS VARIETIES

<table>
<thead>
<tr>
<th>$\Sigma e_1^2$</th>
<th>$\Sigma e_1^2$</th>
<th>$\Sigma e_2^2$</th>
<th>$(n_1+n_2-2k)$</th>
<th>$F^*$</th>
<th>$F(7,286)$ at 1% level</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.44</td>
<td>0.21</td>
<td>0.05</td>
<td>286</td>
<td>33.875</td>
<td>2.64</td>
<td>Structural difference exists between Muscat and Thompson Seedless varieties</td>
</tr>
</tbody>
</table>

From the table 5.2, it is found that the table value of the F-test is 2.64. The computed value of $F^*$ is 33.875. Since the computed value is found to be greater than the table value, it is inferred that there exist a structural differences between Muscat and Thompson Seedless varieties of grapes.

5.1.2. Tests for Stability of Intercept and Slope

Further, the regression model (5.3) was estimated to find out whether the structural differences between two varieties such as Muscat and Thompson existed at slope level and/or at intercept level and the estimated results are presented in Table 5.3.
TABLE 5.3
TEST OF THE STABILITY OF INTERCEPT AND SLOPE BETWEEN FARMERS GROWING MUSCAT AND THOMPSON VARIETIES OF GRAPES

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter Estimate</th>
<th>t – value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>3.7865</td>
<td></td>
</tr>
<tr>
<td>Intercept dummy</td>
<td>0.1965</td>
<td>0.788</td>
</tr>
<tr>
<td>log X1</td>
<td>0.2861*</td>
<td>3.4108</td>
</tr>
<tr>
<td>log X2</td>
<td>0.0613</td>
<td>0.1068</td>
</tr>
<tr>
<td>log X3</td>
<td>0.1418</td>
<td>0.1124</td>
</tr>
<tr>
<td>log X4</td>
<td>0.1173*</td>
<td>3.6922</td>
</tr>
<tr>
<td>log X5</td>
<td>0.0704</td>
<td>0.0092</td>
</tr>
<tr>
<td>log X6</td>
<td>0.3765*</td>
<td>5.4221</td>
</tr>
<tr>
<td>D1 log X1</td>
<td>-0.0803*</td>
<td>-2.7298</td>
</tr>
<tr>
<td>D2 log X2</td>
<td>0.054</td>
<td>0.0008</td>
</tr>
<tr>
<td>D3 log X3</td>
<td>-0.0453</td>
<td>-0.0035</td>
</tr>
</tbody>
</table>
From Table 5.3, the results showed that the coefficient of dummy variable at the intercept level is not statistically significant. It is observed that all the six explanatory variables had positive impact on yield per acre. The variables, human labour, weeding and watch and ward were statistically significant at 5 per cent level. A percentage increase in these variables was capable of increasing yield by 0.2861, 0.1173 and 0.3765 per cent respectively. It is also observed that watch and ward was the most influential variable in relation to yield, followed by human labour. Thus it may be concluded from the analysis that there is no structural difference at intercept level and it existed only at slope level.

Marginal Value Productivity Analysis for Muscat Variety

The analysis of marginal value productivity of resources for Muscat variety is presented in Table 5.4.
# TABLE 5.4

MARGINAL VALUE PRODUCTIVITY OF RESOURCE FOR FARMERS GROWING MUSCUT VARIETY

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Variables</th>
<th>Geometric Mean</th>
<th>Regression Co-efficient</th>
<th>Marginal Value Productivity (B)</th>
<th>Factor Cost (B)</th>
<th>Ratio of MVP to Factor Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gross Returns in rupees per acre (Y)</td>
<td>142698.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Cost of Human labour in rupees per acre (X₁)</td>
<td>13815.87</td>
<td>0.3229</td>
<td>3.34</td>
<td>1.00</td>
<td>3.34</td>
</tr>
<tr>
<td>3.</td>
<td>Cost of fertilizer in rupees per acre (X₂)</td>
<td>13249.22</td>
<td>0.1892</td>
<td>2.04</td>
<td>1.00</td>
<td>2.04</td>
</tr>
<tr>
<td>4.</td>
<td>Cost of pesticides in rupees per acre (X₃)</td>
<td>6478.66</td>
<td>0.1431</td>
<td>3.15</td>
<td>1.00</td>
<td>3.15</td>
</tr>
</tbody>
</table>
It could be observed from Table 5.4 that the ratios of marginal value products to factor costs were 3.34, 2.04, 3.15, 3.08, 3.40 and 2.40 for human labour ($X_1$), fertilizer ($X_2$), pesticides ($X_3$), weeding ($X_4$), manuring ($X_5$) and watch and ward ($X_6$) respectively. It also cleared that there was wide scope for increasing the use of these resources in grape cultivation to push up the gross income because the ratios of marginal value product to factor cost were more than unity.

The relatively increased use of human labour, fertilizer, pesticides, weeding, manuring and watch and ward would augment the income by 3.34, 2.04, 3.15, 3.08, 3.40 and 2.40 times the factor costs respectively. Thus marginal value productivity analysis indicated wide scope for increasing the productivity by resource allocation particularly in the use of human labour, fertilizer, pesticides, weeding, manuring and watch and ward in cultivation of Muscat variety.

**Marginal Value Productivity Analysis of Thompson Variety**
The marginal value productivity of the significant variables, their factor costs and the ratios of marginal value productivity to the acquisition cost of input factors for Thompson variety are presented in Table 5.5.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Geometric Mean</th>
<th>Regression Co-efficient</th>
<th>Marginal Value Productivity</th>
<th>Factor Cost</th>
<th>Ratio of MVP to Factor Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gross Returns in rupees per acre (Y)</td>
<td>157198.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Cost of Human labour in rupees per</td>
<td>12847.11</td>
<td>0.2129</td>
<td>2.60</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Cost of fertilizer in rupees per acre ($X_2$)</td>
<td>15169.38</td>
<td>0.1136</td>
<td>1.18</td>
<td>1.00</td>
</tr>
<tr>
<td>4.</td>
<td>Cost of pesticides in rupees per acre ($X_3$)</td>
<td>6501.63</td>
<td>0.1351</td>
<td>3.27</td>
<td>1.00</td>
</tr>
<tr>
<td>5.</td>
<td>Cost of weeding in rupees per acre ($X_4$)</td>
<td>658.45</td>
<td>0.0202</td>
<td>4.82</td>
<td>1.00</td>
</tr>
<tr>
<td>6.</td>
<td>Cost of manuring in rupees per acre ($X_5$)</td>
<td>9822.97</td>
<td>0.2478</td>
<td>3.97</td>
<td>1.00</td>
</tr>
<tr>
<td>7.</td>
<td>Cost of watch and ward in rupees per acre ($X_6$)</td>
<td>6768.15</td>
<td>0.1669</td>
<td>3.88</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Source:** Computed from Primary Data

Table 5.5 shows that the ratios of marginal value products to factor costs were 2.60, 1.18, 3.27, 4.82, 3.97 and 3.88 for human labour ($X_1$), fertilizer ($X_2$), pesticides ($X_3$), weeding ($X_4$), manuring ($X_5$) and watch and ward ($X_6$) respectively. The relatively increased use of human labour, fertilizer, pesticides, weeding, manuring and watch and ward would fetch additional income by 2.60, 1.18, 3.27, 4.82, 3.97 and 3.88 times the factor costs respectively. Thus, the marginal value productivity analysis showed that these resources were under-utilised and there was scope for increasing the output of grape by using more of these inputs in Thompson variety.

**Marginal Value Productivity Analysis for Overall Sample Farms**
The marginal value products of the significant variables for the entire sample farms were estimated and presented in Table 5.6.

**TABLE 5.6**

MARGINAL VALUE PRODUCTIVITY OF RESOURCE FOR OVERALL SAMPLE FARMERS UNDER GRAPE CULTIVATION

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Variables</th>
<th>Geometric Mean</th>
<th>Regression Co-efficient</th>
<th>Marginal Value Productivity (β)</th>
<th>Factor Cost (λ)</th>
<th>Ratio of MVP to Factor Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gross Returns in rupees per acre (Y)</td>
<td>153948.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Cost of Human labour in rupees per acre (X₁)</td>
<td>13331.49</td>
<td>0.3437</td>
<td>3.97</td>
<td>1.00</td>
<td>3.97</td>
</tr>
<tr>
<td>3.</td>
<td>Cost of fertilizer in rupees per acre (X₂)</td>
<td>14209.30</td>
<td>0.1021</td>
<td>1.11</td>
<td>1.00</td>
<td>1.11</td>
</tr>
<tr>
<td>4.</td>
<td>Cost of pesticides in rupees per acre (X₃)</td>
<td>6490.15</td>
<td>0.0442</td>
<td>1.05</td>
<td>1.00</td>
<td>1.05</td>
</tr>
<tr>
<td>5.</td>
<td>Cost of weeding in rupees per acre (X₄)</td>
<td>668.71</td>
<td>0.0114</td>
<td>2.62</td>
<td>1.00</td>
<td>2.62</td>
</tr>
<tr>
<td>6.</td>
<td>Cost of manuring in rupees per acre (X₅)</td>
<td>9883.92</td>
<td>0.2317</td>
<td>3.60</td>
<td>1.00</td>
<td>3.60</td>
</tr>
<tr>
<td>7.</td>
<td>Cost of watch and</td>
<td>6852.47</td>
<td>0.1093</td>
<td>2.46</td>
<td>1.00</td>
<td>2.46</td>
</tr>
</tbody>
</table>
It could be seen from Table 5.6 that the ratios of marginal value products to the factor costs were 3.97, 1.11, 1.05, 2.62, 3.60 and 2.46 for human labour ($X_1$), fertilizer ($X_2$), pesticides ($X_3$), weeding ($X_4$), manuring ($X_5$) and watch and ward ($X_6$) respectively. The analysis of the marginal value product of grape indicated that a one rupee increase in the cost of human labour, fertilizer, pesticides, weeding, manuring and watch and ward would increase the income by `3.97 `1.11, `1.05, `2.62, `3.60 and `2.46 respectively to the farmers.

5.2 CONSTRAINTS IN GRAPE CULTIVATION

The factors that affect the cultivation and production of grape in the study area were broadly classified into two major heads: They are:

A. Bio-physical constraints, and

B. Socio-economic constraints

The following were the factors identified as the bio-physical constraints

(i) Water shortage

(ii) Soil fertility

(iii) Pest attack
(iv) Weeds

(v) Variety and

(vi) Cultural practices.

The socio-economic constraints identified were

(i) Credit

(ii) Lack of input availability

(iii) Economic behaviour

(iii) Risk aversion

(iv) Knowledge

(iv) Institutions and

(v) Traditions.

In order to identify the main constraints to potential yield of grape, Garrett’s ranking technique was adopted. The sample grape farmers producing grape under Muscat and Thompson Seedless varieties were asked to rank the constraints faced by them as per priority. The rank assigned to each constraint by the respondents was converted into percentages by using the following formula:

\[
100 \left( R_{ij} - 0.5 \right)
\]

Per cent position = -------------------------
$N_j$

where,

\[ R_{ij} = \text{Rank given by the } j^{\text{th}} \text{ individual for the } i^{\text{th}} \text{ factor, and} \]

\[ N_j = \text{Number of factors ranked by the } j^{\text{th}} \text{ individual.} \]

The per cent position thus obtained was converted into scores by referring to the Garrett’s ranking table. The scores of all respondents for each factor were added together and then divided by the number of respondents experiencing that particular constraint. The mean scores of each factor were arranged in descending order and the corresponding ranks allotted.

The farmers cultivating Muscat / Thompson Seedless grape reported five factors among various bio-physical and socio-economic constraints as the major yield constraints. These constraints limit the farmers cultivating grape of both varieties from achieving the potential yield in the study area. These factors are (a) pest attack, (b) weeds, (c) water shortage, (d) credit, (e) lack of input availability. Table 5.7 shows the yield constraints faced by the farmers of Muscat variety.
Table 5.7 shows that pest attack was ranked first followed by weeds. The water shortage was ranked third; credit was ranked fourth and lack of input availability was given fifth rank.

In Thompson grape cultivation, the factors identified as yield constraints are given in Table 5.8

**TABLE 5.8**

**YIELD CONSTRAINTS IN THOMPSON SEEDLESS VARIETY**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Constraints</th>
<th>Mean Score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pest attack</td>
<td>66.59</td>
<td>I</td>
</tr>
<tr>
<td>2.</td>
<td>Weeds</td>
<td>63.46</td>
<td>II</td>
</tr>
<tr>
<td>3.</td>
<td>Water shortage</td>
<td>54.42</td>
<td>III</td>
</tr>
<tr>
<td>4.</td>
<td>Credit</td>
<td>48.15</td>
<td>IV</td>
</tr>
<tr>
<td>5.</td>
<td>Lack of input availability</td>
<td>39.77</td>
<td>V</td>
</tr>
</tbody>
</table>
It is found from Table 5.8 that the water shortage was found to be the major constraint to achieve the potential yield in the study area among Thompson variety cultivators. Pest attack was pointed out to be the second factor affecting the achievement of maximum yield. Weeds were ranked third followed by lack of input availability which was ranked fourth. Credit was given fifth rank.

It is observed that pest attack was the major constraint in Muscat variety while water shortage was observed to be the major constraint in Thompson variety in the study area. This was followed by other factors with minor variations in priority assigned by the grape cultivators in Muscat and Thompson varieties.

### CHAPTER VI

**CHANNELS OF DISTRIBUTION OF GRAPE CULTIVATION**